ENERGY NOTES

Revised December 2000

Montana's Statewide COMMERCIAL BUILDINGS ENERGY CODE

COVERED IN THIS ISSUE

LIGHTING REQUIREMENTS

MECHANICAL REQUIREMENTS

ENVELOPE REQUIREMENTS

Overview

The Administrative Rules of Montana (Section 8.70.104) require that commercial buildings and residential structures over three stories must comply with the Model Energy Code ASHRAE/IES Standard 90.1-1989. This code regulates envelope requirements, lighting, mechanical and water heating equipment.

This issue of Energy Notes describes methods that many Montana commerical buildings can use to comply with the Model Energy Code.

The information in this Energy Notes Newsletter is based on COM*check-EZ*™. COM*check-EZ* was developed by the U.S. Department of Energy as a simplified way to qualify buildings for ASHRAE Standard 90.1 compliance. COM*check-EZ* includes a manual method (prescriptive compliance path) and a software method, available free of charge on the internet at **http://www.energycodes.org** or by calling the Montana Department of Environmental Quality at (406) 444-6697. Commercial buildings can also show code compliance by using the ASHRAE 90.1 manual. The code doesn't apply to buildings or portions of buildings intended primarily for manufacturing or industrial processing or buildings that are not heated. Alterations to existing conditioned spaces must comply with COM*check-EZ* requirements, unchanged portions do not have to comply. Residential buildings three stories or less above grade are covered under the residential energy code.

Lighting Requirements

Interior Lighting

Switching requirements - independent controls are required for each area enclosed by ceiling-height partitions. These controls can be a switch located so the occupant can see the area controlled by the switch, an on/off indicating switch, or an occupancy sensing device. Exceptions are dwelling units, security areas, emergency exits and public areas such as retail stores where a switch can control the entire area.

One- and three-lamp fluorescent fixtures must be tandem wired if they are pendant or surface mounted lights in continuous rows or recess-mounted within 10 feet of each other and controlled by the same switch. Exceptions are lights with electronic high-frequency ballasts or lights not on the same switch or in the same area.

Lighting controls must allow at least a 50 percent reduction in light levels in a reasonably uniform pattern. Bi-level switching is not required if the area has only one light, has an occupant-sensing device, or is a corridor, storage area, restroom, or lobby.

Hotel and motel guest rooms are required to have a master switch at the main entry controlling all permanently wired lighting fixtures and switched receptacles excluding bathrooms. Or, if multi-room units, a switch is required at the entrance to each separate room.

Interior Lighting Level Limits

Two options are available for interior lighting compliance.

1. Limit on the amount of lighting

Determine if the total lighting load, number of lights *(in watts)* for the area is equal to or less than those listed in the table below.

	Watts Per Sq. Ft.	
Building or Area Type	**Entire Area**	**Tenant Area**
Auditorium	N/A	1.6
Bank/Financial Institution	N/A	2.0
Classroom/Lecture Hall	N/A	2.0
Convention/Conference/Meeting	N/A	1.8
Corridor/Restroom/Support	N/A	0.8
Dining	N/A	2.5
Exercise Center	0.9	1.0
Exhibition Hall	N/A	2.6
Grocery Hall	2.8	2.8
Hotel Function	N/A	2.4
Industrial Work - General	N/A	1.6
Industrial Work - Precision	N/A	2.5
Kitchen	N/A	1.4
Library	1.3	1.8
Lobby - Hotel	N/A	1.8
Lobby - Other	N/A	2.5
Mail/Arcade/Atrium	N/A	N/A
Medical/Clinical Care	1.8	3.1
Office	1.7	N/A
Religious Worship	N/A	2.5
Restaurant	1.7	N/A
Retail/Sales, Wholesale Showroom	2.8	3.1
School	1.9	N/A
Storage - Commercial/Industrial	0.6	1.0
Theater - Motion Picture	1.1	1.0
Theater - Performance	1.4	1.5
Other	0.6	0.6

The amount of lighting allowed depends on the use or type of building and whether it is for an entire area or specific tenant area. Additional information on wattages for building types and compliance worksheets are included in the COM*check-EZ* manual.

2. Unlimited amount of energy efficient lighting

The second option allows an unlimited number of lighting fixtures provided they are one- or two-lamp non-lensed fluorescent fixtures with electronic ballast and fitted with bulbs T-5, T-6, T-8 or PL type (plug in) from 5 to 50 watts per lamp.

Exception for both interior and exterior lighting requirements. Up to 5 percent of the installed lighting fixtures may use any type of lamp.

Exterior Lighting

Switching requirements - Controls must automatically turn off exterior lighting during daylight hours. Controls may be directional photocell, or astronomical time switch. Exceptions are safety/emergency lighting, signage, lights in tunnels, parking garages and other large covered areas where lights must be on during the day.

Exterior lighting level limits - All exterior lighting supplied through the building electrical service must have an efficacy of at least 45 lumens per watt. Examples of lighting sources meeting this requirement are: fluorescent, metal halide, high pressure sodium, low pressure sodium and electrodeless induction lamps.

These requirements do not apply to lighting for: advertising signage, safety or security for health and safety requirements or low voltage landscaping.

Mechanical Requirements

COM*check-EZ* requires at least minimum equipment efficiency at peak- and part-load conditions. All new HVAC equipment will meet this requirement.

Control Requirements

A thermostat is required to control heating and cooling in each zone. It must have the capability to automatically set back or shut down heating and cooling when appropriate. It must have accessible overrides so occupants can operate the system during off-hours. Operating and maintenance manuals for the HVAC equipment must be left with the building owner.

Hydronic heating requirements - If heat is provided through the use of individually controlled radiators or fan-coils served by a central hot water boiler, then the following components are required:

1. thermostats for each individual heating zone;
2. new equipment boilers and circulation pumps;
3. (for systems under 600,000 Btu per hour) pipe insulation of at least .5-inch thickness on all branches for individual terminal units and 1.5 inch thickness on all circulation loop piping;
4. variable flow controls on the circulation pump or temperature reset controls for systems with capacities over 600,000 Btu per hour—to increase efficiency during part-load operation.

Duct Insulation Requirements

HVAC ducts (*both supply and return*) must be insulated to a minimum of R-8 if they are located outside the building envelope. HVAC duct insulation is not required inside the building envelope.

Insulation is not required on exhaust air ducts, ducts located within equipment, and in situations where the design temperature difference between the interior and exterior of the duct does not exceed 15 degrees F.

Air Economizer Systems

Integrated controlled economizers are required on all cooling systems with a total capacity of 90,000 Btu per hour (7 1/2 tons) or larger. Exceptions are residences, supermarkets or hotel/motel guest rooms.

Ventilation - Minimum Outdoor Air Requirements

Customarily occupied spaces shall be provided with natural ventilation by means of openable exterior openings with an area not less that 1/20 of the total floor area or shall be provided with a mechanically operated ventilation system.

If the building is mechanically ventilated, the system must include a damper to prevent air infiltration during periods of nonuse.

Occupancy type	Outdoor Ventilation Air (cfm per sq. ft. of area)
Applications similar to:	
Auditorium	2.25
Barber Shop	0.38
Bar, Cocktail Lounge	3.0
Beauty Shop	.63
Cafeteria /Fast Food	2.0
Gambling Casino	3.6
Dry Cleaning	.9
Hotel Guest Room	30 cfm/room
Office	.14
Retail Store (basement and street)	.30
Retail Store (upper floors)/mall	.2
All Others and High–rise Residential are Listed in UBC Table A 12-A	

Water Heating Requirements

Water heating equipment shall meet the requirements of the National Appliance Energy Conservation Act of 1987. All gas-fired water heaters that use indoor air for draft hood dilution and are installed in a conditioned space shall be equipped with an automatically operated vent damper.

Noncirculating systems require heat traps and 1/2-inch thick insulation on outlet and inlet piping. Insulation is required on the first 8 feet of outlet piping and from the storage tank if used through the heat trap on the inlet side.

If an external heat trap is used on the inlet side, all trap area piping should be insulated.

Circulating systems require automatic time switch controls to shut down the pump during periods of nonuse. One-inch thick insulation is required on the first 8 feet of outlet piping.

Envelope Requirements

The path listed below will comply anywhere in Montana. COM*check-EZ* divides Montana into two climate zones (zones 15 and 16). In order to simplify this path, insulation levels are based on Zone 16, which requires slightly higher requirements. COM*check-EZ* Prescriptive Packages or the COM*check-EZ* computer program may allow some slightly lower insulation requirements for some Montana counties. A description of zones and Prescriptive Packages are shown on pages, 7, 8 and 9 of this newsletter.

Glazing

Glazing units are listed in maximum U factors, a measurement of conductivity. The U factor is the inverse of the R factor. Example: an R factor of 2 would equal a U factor of 1/2 or .5. Most windows will have National Fenestration Rating Council (NFRC) labels listing U factor and Solar Heat Gain Coefficient (SHGC). Most manufacturers should have NFRC and SHGC information available. Default U factor and SHGC tables are listed in the COM*check-EZ* manual. The glazing unit should have a U factor and SHGC no higher (less efficient) than the listing. (A U factor of .5 is better than a U factor of .6.)

The required U factor depends on the amount of glazing in the building. Requirements are listed under window/wall ratio which is the gross window area divided by the gross wall area. The gross wall area includes the opaque area of all above-grade exterior walls, including the band joist and the area of all doors and windows. The gross window area includes the rough opening area of the windows, not just the transparent glass area.

Window/Wall Ratio	U-factor	Solar Heat Gain Coefficient
0-10%	.6	.9
11-25%	.5	.7
26-40%	.4	.5

Skylight

Maximum U-factor of .6 with a limit of 3% or less of roof area

Insulation Requirements

“Cavity insulation” is the placement of insulation in cavities, such as spaces between framed walls, studs or floor joists. The insulation should fill all voids but not be compressed.

“Continuous insulation” differs from cavity insulation only in how it is placed over structural components rather than in cavities. Continuous insulation, when properly installed, is free of breaks, voids and compression.

Floors *(over unheated space)*

All wood joist/truss

Continuous - R-22, or
Cavity - R-25

Non-wood joist/truss

Continuous - R-23, or
Cavity - R-30

Concrete slab or deck
Continuous - R-22

Foundation wall insulation may be substituted for floor insulation in (non-vented) crawlspaces. Foundation walls would have to meet the insulation requirements for above grade walls listed below. For example, a masonry or solid concrete wall would require an insulation level of continuous R-10.

Doors
No specific insulation requirements, provided door area is less than 5% of gross wall area. If the door area exceeds 5%, then doors must meet the R value for exterior walls or compliance must be domonstrated using the software method. Sliding glass doors and atrium doors used primarily as a window must meet requirements for windows.

Roof
Joist/truss systems
Continuous - R-24, or
Cavity - R-30
Concrete deck or metal purlin
Continuous - R-24

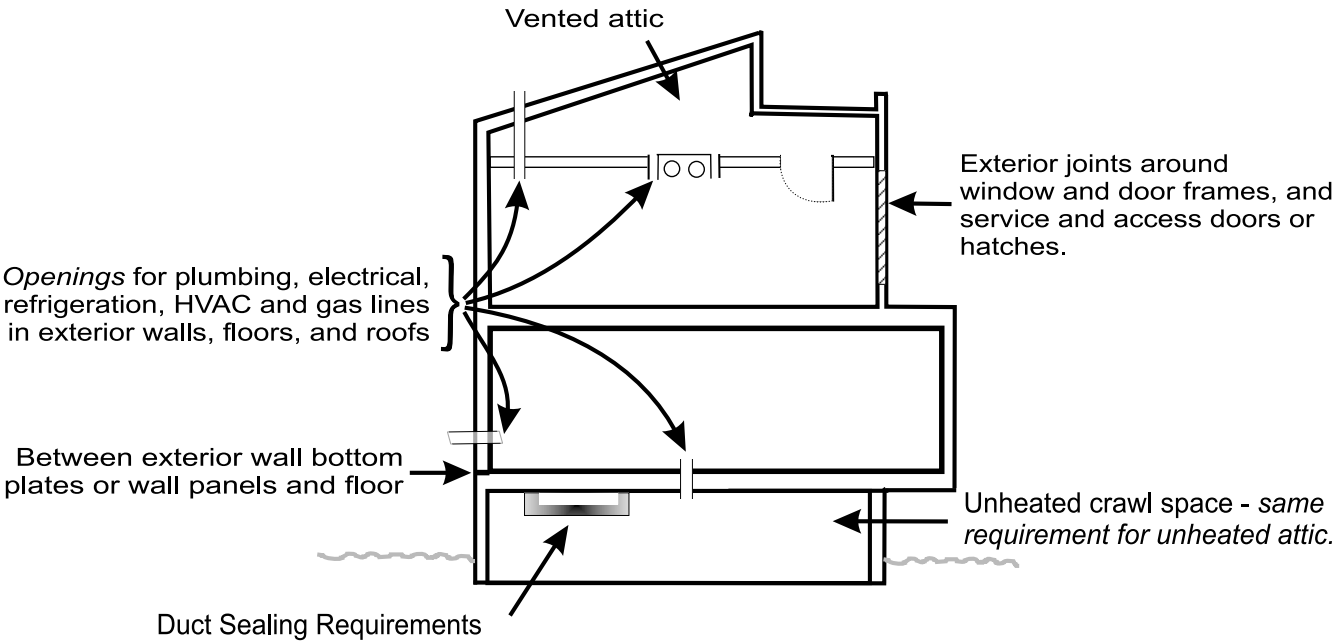
Above Grade Walls
Wood framing - R-13
Metal framing - R-13 with R-3 continuous
Concrete masonry unit (8-inches or greater) **In all cases cores must be insulated**
Continuous - R-6
Framed with wood wall - R-11
Framed with metal wall - R-13
All other masonry -
Continuous - R-10
Framed with wood wall - R-13
Framed with metal wall - R-13 with R-3 continuous

Basement Walls
R-8
Basement walls have at least 85% of their area below grade

Slab Edge
R-8
Slab edge insulation is not required for Zone 15 buildings with a 10% or less window/wall ratio. R-8 insulation may be installed vertically or horizontally on the inside or outside of the foundation wall. If installed vertically, it must extend downward from the top of the slab to the top of the footing, or 48-inches, whichever is less. If installed horizontally, it must cover the slab edge and then extend horizontally to the interior or exterior for a minimum of 40-inches.

Air sealing requirements - All joints and penetrations in the building envelope that are potential sources of air leakage must be caulked, gasketed, weather-stripped, or otherwise sealed in an approved manner.

The following areas must be sealed:



Duct Sealing Requirements
HVAC ducts (*both supply and return*) must have all joints, longitudinal and transverse seams and connections securely fastened and sealed with welds, gaskets, mastics, mastics plus embedded fabric systems or tapes. Tapes and mastics used to seal ducts must be listed and labeled in accordance with UL 181A or UL 181B. Most cloth duct tapes will not meet the UL criteria.

Duct registers, grilles and diffusers must be sealed to the gypsum board or other interior finish. Penetrations into supply or return plenums and building cavities used for air plenums or ducts must also be sealed.

Vapor Retarders

Vapor retarders (poly sheeting, vapor barrier paint, etc.) must be installed in all nonvented framed areas in ceilings, walls and floors. Nonvented areas are framed cavities without vents or other openings to allow for free air movement. The vapor retarder must have a permeability (perm) rating of 1.0 or less and must be installed on the warm-in-winter side of the insulation.